WRIGHT'S BRIDGE
National Covered Bridges Recording Project
Spanning Sugar River, former Boston & Maine Railroad (originally Concord & Claremont Railroad)
Claremont vicinity
Sullivan County
New Hampshire

HAER NH-35
NH-35

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
1849 C Street NW
Washington, DC 20240-0001

HISTORIC AMERICAN ENGINEERING RECORD

WRIGHT'S BRIDGE

HAER No. NH-35

LOCATION:	Spanning Sugar River, former Boston & Maine Railroad (originally Concord & Claremont Railroad), Claremont vicinity, Sullivan County, New Hampshire UTM: 18.723535.4804738 Claremont, NH Quad
DATE OF CONSTRUCTION:	1905-06
STRUCTURAL TYPE:	Double Town lattice truss with integral laminated arch
DESIGNER/ BUILDER:	Boston & Maine Railroad
PRESENT OWNER:	New Hampshire Dept. of Resources and Economic Development
PREVIOUS USE:	Railroad bridge until 1977
PRESENT USE:	Recreational trail
SIGNIFICANCE:	One of only eight remaining covered railroad bridges in the country. Wright's Bridge is structurally the most interesting of the four existing bridges built while Jonathan Parker Snow was bridge engineer at the Boston & Maine Railroad. The use of the arch, which is original here, effected modifications to the lattice design. Snow was an important advocate for wooden bridges into the early twentieth century.
HISTORIAN:	Joseph D. Conwill, Editor, Covered Bridge Topics, July 2002
PROJECT INFORMATION:	The National Covered Bridges Recording Project is part of the Historic American Engineering Record (HAER), a long-range program to document historically significant engineering and industrial works in the United States. HAER is administered by the Historic American Buildings Survey/Historic American Engineering Record, a division of the National Park Service, U.S. Department of the Interior. The Federal Highway Administration funded the project.

CHRONOLOGY

1835	Ithiel Town patents the double lattice truss
1848	Concord & Claremont Railroad chartered
1848	Jonathan Parker Snow born at Concord, New Hampshire
1872	Railroad completed to Claremont and original Wright's Bridge built
1875	J.P. Snow receives his civil engineering degree
1887	Boston & Maine Railroad absorbs the Concord & Claremont
1888	J.P. Snow begins service as Bridge Engineer at Boston & Maine
1905/06	Present Wright's Bridge built
1909	J.P. Snow becomes Chief Engineer at Boston & Maine
1911	J.P. Snow retires; wooden truss bridge construction stops
1933	Death of J.P. Snow
1954	Samuel M. Pinsley buys the railroad line
1977	All service is abandoned

COVERED RAILROAD BRIDGES

Covered wooden truss bridges were indispensable to America's nineteenth-century railroads, just as they were to our road systems. Today they are extremely rare. Of the eight remaining nationally, the only one in service is at Clark's Trading Post in Lincoln, New Hampshire (see HAER No. NH-39), and it is only a tourist railroad.[1] Rolling stock increased rapidly in weight as railroad technology developed, dooming early bridges.

By the late nineteenth century, most railroad bridges were being built of iron or steel. For some applications timber was still cheaper, and two regions saw covered railroad bridge construction into the early twentieth century. In the Pacific Northwest they served various logging lines, with a concentration on the Chicago, Milwaukee, St. Paul & Pacific system. Only one remains in the region today at Cotton Grove, Oregon. Built for a small logging company, it was in service only for a short time and is now in very poor condition.[2]

New England has the other seven covered railroad bridges. Four of these were built because of the influence of Jonathan Parker Snow (1848-1933), Bridge Engineer for the Boston & Maine system. Wright's Bridge is part of Snow's legacy.

SUGAR RIVER RAILROAD

The Concord & Claremont Railroad received a charter in 1848 for a line extending west-northwest from Concord to Bradford, Newport, and Claremont.[3] Work was soon completed to Bradford, but financial and engineering difficulties prevented its further extension until the early 1870s. At that time a separate company (the Sugar River Railroad) was incorporated to finish the work as described in the original charter. Service was completed through Newport to Claremont by September 1872.

The rail line followed Sugar River closely, and crossed it fourteen times on double town lattice truss bridges, all but one of which were covered.[4] Two were eliminated in the late 1890s because of a change in the course of the river. The Sugar River Railroad bought

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[1] In saying that this is "only" a tourist railroad, I do not mean to denigrate the substantial effort involved in preserving the structure as the last covered railroad bridge in the country still used by trains. The point is that covered railroad bridges have completely disappeared from regular service.

[2] In addition, there is a through truss at Harpole, Washington (near Colfax) whose trusses are completely boxed separately, with no roof. Due to the influence of historian Kramer A. Adams, such structures have sometimes been listed as covered bridges, although they are not covered in the usual sense.

[3] Robert M. Lindsell, The Rail Lines of Northern New England (Pepperell, Massachusetts: Branch Line Press, 2000) has a good summary of the line's history on pp.118-122.

[4] Two valuation surveys offer a wealth of information on the bridges of the line. One was prepared when the Boston & Lowell Railroad leased the Northern Railroad in 1884, and the Interstate Commerce Commission did the second in 1914. Wayne Perry has compiled the results in a very useful table in "Northern Railroad Bridges" Covered Bridge Topics, Spring 1984, pp. 6-9.

right-of-way land from S.K. Wright in 1871 and built the original 120' covered bridge that bears his name in 1872.[5]

Consolidation of America's railroad system in the late nineteenth century brought a succession of new owners to the line and its bridges. In 1873 the Concord & Claremont absorbed the Sugar River line, but it in turn was already under the control of the Northern Railroad. The Boston & Lowell Railroad leased the Northern in 1884, and then it was swallowed up in the vast Boston & Maine system in 1887, bringing long-term stability to the route.

WRIGHT'S BRIDGE

Boston & Maine replaced the original Wright's Bridge with the present structure in 1905-06.[6] The new bridge was longer than the old at 136' and required the preparation of new abutments.[7] At various points in its history the bridge carried number 178, or 50-26.

Area railroad service declined after World War II, and Boston & Maine proposed abandonment of this route in 1954. Instead, Samuel M. Pinsley, who owned several New England short lines, bought the route and incorporated a new Concord & Claremont Railway. Passenger service through Wright's Bridge ended in 1955, and the line was gradually abandoned, starting from its east end, which was the part built first. The section between Newport and Claremont saw its last regular freight train in 1977. After the abandonment, Pinsley threatened to tear down Wright's Bridge and the nearby Pier Bridge, which is also covered. He seems to have been annoyed by preservation efforts.[8] After some negotiation, the State of New Hampshire bought the roadbed along with the two covered bridges. After removal of the tracks, the route was eventually converted to a recreational trail for all-terrain vehicles, horses, hikers, and in winter, snowmobiles. The trail is well used and the bridges are much appreciated, although they do need some work.

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[5] Nomination form for National Register of Historic Places, 1975. Perhaps work was begun in 1871, but the 1884 Valuation Survey gives a date of 1872.

[6] The 1914 Valuation Survey says 1905, and Richard Sanders Allen concurs in Covered Bridges of the Northeast (Brattleboro, Vermont; Stephen Greene Press, 1957), Appendix 1, p. 113. Other sources say 1906.

[7] At the time of my field visits the river was high, and it was not possible to find traces of the old abutments.

[8] "Railroad's Owner Angry, Covered Bridges Coming Down" [Claremont, New Hampshire] Eagle Times, February 8, 1977, p. 1. Thanks to James L. Garvin of the New Hampshire Division of Historical Resources for bringing this source, and various others, to my attention.

JONATHAN PARKER SNOW

The engineer to whom we owe the construction of half our nation's remaining stock of covered railroad bridges was born at Concord, New Hampshire in 1848.[9] His father, Jonathan Snow, was a blacksmith and machinist. His mother, Lydia Ann Parker, died while he was still an infant, and he was raised by an aunt on a hill farm in Nelson, New Hampshire. After attending the local district school, he spent two years at a private academy in Contoocook. Like many young men of his day, he contemplated a career at sea. Later he decided on civil engineering and enrolled in Thayer School of Civil Engineering, associated with Dartmouth College, receiving his degree in 1875.

Snow later told young men that for the first ten years after graduation they should spend no more than two years in any one place, and he followed this advice himself. For the first few years after school he worked at mining in North Carolina, at surveying in Prince Edward Island, and at various other tasks. He also served as an instructor in civil engineering at Thayer and prepared useful course notes on various aspects of the field, as textbooks were then rare. In 1880 he took a position as a draftsman with the Boston Bridge Works and stayed there several years, but he tired of indoor work. Then in 1884 he began service as Bridge Engineer with J.W. Ellis, C.E. in Woonsocket, Rhode Island. In this capacity he had occasion to do work for the Providence & Worcester Railroad.

Early in his railroad work, Snow became convinced that wooden trusses were still efficient, and that they should be maintained in service as long as possible instead of being replaced with iron trusses. Though described as a man of few words, his views on wooden trusses may have led to his selection as Bridge Engineer with the Boston & Maine Railroad in 1888, for this system had many such structures and served a region rich in timber. Snow not only maintained older wooden trusses, but also he built many new ones almost up to his retirement in 1911. He became Chief Engineer at Boston & Maine in 1909, but he retired when the system became associated with the New Haven Railroad. When he left, Boston & Maine stopped building wooden trusses. Snow continued to work as a private consultant with an office at 18 Tremont Street in Boston until his death in 1933.

At the time of J.P. Snow's service, the Sugar River Railroad was part of the Boston & Maine system. He replaced most of the bridges, sometimes using metal riveted trusses or plate girders, but for Wright's Bridge he built a new wooden lattice truss.

Snow always held his own opinions, and in the great debate over steel truss joints, he favored rivets over pins.[10] He advised young engineers to say little but observe much, in essence to "restrain their knowledge until it was needed," and he said that much of value

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[9] Most of the information in this section comes from a file of Snow's papers in the Special Collections Department, Rauner Library, Dartmouth College. Thanks to Mary Donin for locating this material.
[10] American Society of Civil Engineers, American Wooden Bridges (New York: ASCE Historical Publication No. 4, 1976), p. 28.

could be learned from workmen on the job. Though married, he had only one child, who died in infancy. His legacy is his engineering work, well exemplified by Wright's Bridge.

SNOW ON THE USE OF WOOD

In an 1895 article, Snow described his practice in detail.[11] In that year the Boston & Maine Railroad had 1,561 bridges of all kinds, including both overpasses and track bridges. Of these, 1,085 or nearly 70 percent were wood, either trestles, stringers, pony queenposts and Howe trusses, or through Town lattice trusses like Wright's Bridge. Over half the bridge replacements were still being built of wood. For longer through spans, Howe trusses of southern pine cost almost as much as iron bridges, and the local spruce was unsuited to Howe truss work because of its tendency to warp. Spruce was ideally suited to the Town lattice truss. For various reasons, the loads calculated for wooden trusses were somewhat less than those used for iron or steel. While wooden trusses might have a shorter service life, they could be easily reinforced if necessary, and they gave ample evidence of distress long before failure. In 1895, a single-track bridge of 120' span cost about $5,300 in iron, $5,000 for a Howe truss of southern pine with iron angle blocks, but only $3,500 for a spruce lattice. In shorter spans the cost advantage for wood was even greater, but in longer spans there was much less advantage. Sometimes southern pine was used for lower chord sticks in spans of 100' or more because it was difficult to find local spruce long enough.

THE DOUBLED TOWN LATTICE TRUSS

Ithiel Town, in his 1835 patent, already foresaw doubled lattice trusses. Occasionally they were built as highway bridges, but the principal use was for railroads.[12] Snow pointed out that single lattice trusses could safely carry railroad loadings in spans up to 80', but they tended to warp under heavy loads. The double lattice was more rigid because it functioned something like a box girder.

Many authorities have called the doubled truss a Town-Pratt railroad lattice, on the theory that T. Willis Pratt was involved in its development. Pratt worked for a time as an engineer with the Eastern Railroad, one of the many lines that later formed the Boston & Maine system. In the early 1870s he patented three little-known bridge designs, apparently inspired by his railroad work. One of these, patent no. 137,482 of April 1, 1873, was for a wooden plank truss assembled with treenails that is sometimes loosely

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[11] J. Parker Snow, "Wooden Bridge Construction on the Boston and Maine Railroad," Journal of the Association of Engineering Societies 15, no. 1 (July 1895), pp. 31-43. This source is hard to find, but a slight abridgement was published in Covered Bridge Topics, Winter 1980, pp. 3-5.

[12] Such as the former Caribou Crossing at Presque Isle, Maine, built in 1885 and removed in 1932. This was a wide two-lane bridge without a center truss, which may explain the choice of a doubled lattice.

described as a lattice. Pratt is said to have used it for at least one railroad bridge, and from these facts has arisen the designation "Town-Pratt lattice."[13]

Pratt's 1873 patent was really a Warren girder in form, with no resemblance to a lattice except in its construction details (use of plank assembled with large treenails). Snow himself discussed the origins of the doubled Town lattice in his 1895 paper, and he made no mention of T. Willis Pratt. Instead, he says he followed the precedent of David Hazelton (1832-?), who had been Master of Bridges and Buildings for the old Boston & Lowell Railroad.[14] Hazelton was a bridge wright, not a college-trained engineer, but Snow had a warm admiration for his abilities. Hazelton no doubt drew upon the craftsman tradition of New England bridge building tracing directly back to the influence of Ithiel Town himself. The designation "Town-Pratt" for the doubled lattice truss seems to be in error.

STRUCTURAL DETAILS

J.P. Snow understood the capabilities of the doubled Town lattice truss, and he varied it to suit different applications. In some structures, such as the former Hillsborough, New Hampshire railroad bridge, he varied plank size through the length of the span, using wider plank towards the ends.[15] His major refinement in truss design was an ingenious solution to the problem of critical least section in lower chords. These members are in tension, and unless the chords are single sticks through the entire length of the span, the joints are a problem. In Town trusses the chord planks butt directly together end for end, with no scarf joint. There are several thicknesses of plank in the chords and the joints are carefully staggered, but where there are joints, those planks that continue solid are the only ones carrying the load. Snow devised a method of connecting the plank ends by means of jib bars bridging the joint, fastened with rods bored through the width of the timber.

Because of the long span of Wright's Bridge, Snow used a different modification. He included a mammoth laminated arch in between the two sets of lattices. The lattice itself is lighter than usual and does not have secondary chords on top. This suggests that the arch was intended to carry most of the load. Construction plans for Wright's Bridge have not been located, but the former railroad bridge at Goffstown, New Hampshire was

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[13] On the Conway and Great Falls branch of the Eastern Railroad; see Richard Sanders Allen, "The Merrimack in Massachusetts – Bridge by Bridge, Addenda," Covered Bridge Topics, Winter 1999, p. 7-8. One highway bridge of unknown builder, the former Runnell's Bridge of Hollis, New Hampshire, also appears to have been of this type.

[14] Sometimes spelled Haselton, but he himself wrote Hazelton. Original bridge plans by David Hazelton are among the George B. Pease Papers recently donated to the Archives of the National Society for the Preservation of Covered Bridges at Westminster, Vermont; thanks to David W. Wright for bringing this to my attention.

[15] Thanks to Wayne Perry for his careful observations of the more arcane framing details of Boston & Maine bridges; telephone conversation June 22, 2002.

similar. Its plan included a note plainly stating that the arch was to carry most of the load.

The arches are built up of twenty-two leaves of mostly 2-3/4" x 9" plank, but the bottom three leaves are thinner. The bottom two measure 7/8" thick and the third is 1-3/4". This feature probably facilitated bending the plank to the required curve. The total assembled depth is 4'-9 3/4", not 6' as sometimes stated.[16] The iron hanger rods are of 1-3/4" diameter stock on 4'-6" centers, which corresponds to the spacing of the lattice joints. They do not support the floor beams directly, but instead pass through holes bored in the central section of the three-part lower chord and are fastened below this with large washers. The rods are all equipped with turnbuckles to permit the correct load to be transmitted from the chord to the arch.

Because of the arch, the lower chords differ from other railroad lattices such as the nearby Pier Bridge, one mile to the east. At Pier, the lower primary chord uses tripled 3-3/4" x 14" plank inside and outside, and doubled 2-3/4" x 14" for the central part between the two lattice webs; iron jib bars connect the plank joints at their ends. At Wright's, the inside and outside parts of the lower primary chords use two 2-3/4" x 11-3/4" planks. The center uses the same size plank but it is tripled to make room for the arch. The lattice webs are thus spaced further apart than usual. There are no jib bars at the chord joints in Wright's Bridge.

The lower secondary chords are of the same dimensions as the lower primaries for the center section, but use only 2-1/4" x 11-3/4" plank for the inside and outside parts. The top chords were not measured because of difficult access, but there are no secondary chords, and the primaries appear to be of the same dimensions as the lower secondary chords. This light construction indicates that the arch was intended to do most of the work.

The lattice planks vary from 2-1/4" x 11-1/2" to 2-1/4" x 11- 3/4", with a slight increase to 2-1/4" x 12" at the very ends of the bridge. The nearby Pier Bridge, which does not have an arch, uses thicker plank, 2-3/4" x 12" in the centers of the spans, increasing to 2-3/4" x 12-1/2" and finally 2-3/4" x 13" at the ends. Joints at Wright's Bridge are spaced apart 4'-6" on center for width, and about 7'-4 1/2" for height. The joints for the two webs are staggered, which is the usual practice. The truss is three diamonds high.

The upper lateral bracing is of Howe style, but with the addition of four heavy wooden cross timbers to which ship's knees are fitted as sway bracing, a very elegant feature. The central two ship's knees foot upon the arch, while the end two foot upon vertical posts added to the truss. The lower lateral bracing is also of Howe style.

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[16] Measurements come from my field notes of June 22, 2002, and they differ in some particulars from details previously published. Note that the plank thicknesses cited above add up to 4'-7 3/4". There are no observable gaps between the planks, and the additional 2" may be explained by slight manufacturing variations.

The floor beams are 7-1/2" x 17-1/2" with some variation, on 2'-3" centers, i.e., half the lattice spacing. Since the lattice webs are staggered, each can support a floor beam in its place. The beams are suspended below the lower chords by short hanger rods from wooden blocks, which bridge alternately between inside chord and center or center chord and outside, as the lattice web allows. Stringers measure 6"x10"; there are four, grouped in two pairs under the former rails. They rest atop the floor beams, and are cut out around the lower lateral bracing. The railroad ties are still in place, but the rails are gone. There is now a longitudinal plank deck for the recreational trail.

The abutments are of large granite blocks in regular courses, and mortared. They were probably built new for the present bridge, as the previous one was 16' shorter. The arches end on large wooden skewbacks footing upon stones that jut out from the abutment wall specifically for this purpose.

In all of its details, both of engineering and of construction, Wright's Bridge represents the highest development of the covered bridge art.

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Valuation Surveys, 1884 and 1914.